# SCIENCE

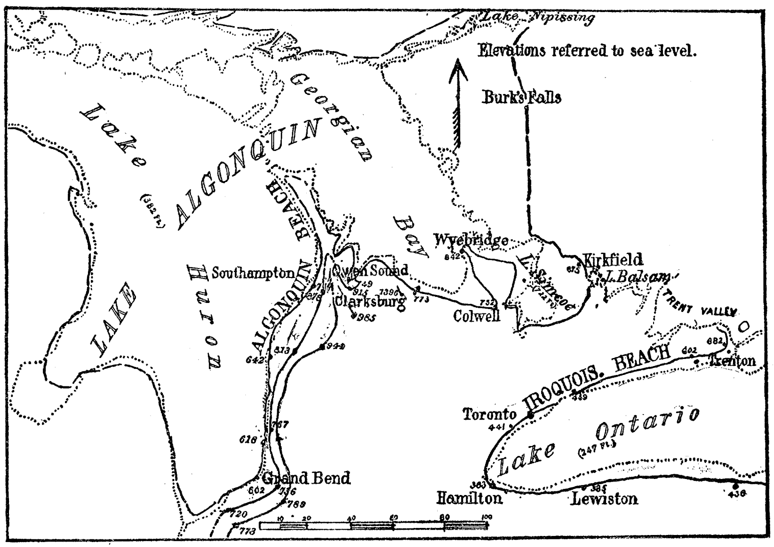
NEW YORK, DECEMBER 1, 1893.

## REVIEW OF THE BIRTH OF THE GREAT LAKES AND THEIR DESERTED SHORES.[1]

PAGE after page in the history of our Great Lakes has been deciphered by the researches of Dr. J. W. Spencer. This study has involved many of the most important questions in dynamical geology. First there was the long continued high continental elevation, during which the Laurentian valley was excavated by the erosion of the great river, its tributaries and the multitudinous branches. Afterwards, the old topography became disfigured, the hills were swept off and the valleys filled up, and all the other changes of the ice age followed, with the drowning of the lower lands by the encroachments of the sea upon the sinking continent. The lands had given place to the sea; now the sea receded from rising lands. In the olden days, the mountains had been worn down to mere trunks, but with the pleistocene re-elevation which lifted the later shore-lines the old water-levels were deformed and broken. In our issue of June 3rd, 1892, we described the manner in which the lake basins had been formed—just ancient valleys closed by drift and by the warping of the earth's crust in proximity to some of their outlets. Then the history of these fresh-water lakes began. Fragments of their story have now been discovered, and their well preserved but deserted beaches mark the shrinkage of the waters.

About the close of the ice age, one great sheet of water covered most of the Great Lake region, occupying 200,000 square miles or more. This was Warren water, whether salt or fresh is not yet known. Its shores upon both sides of the Superior basin, about Lake Michigan and Lake Huron, on both sides of Erie, in Ontario and New York, are now more or less known, but not the northeastern limits. This is an enormous area for only three or four workers to cover: nearly the whole region by the author under review; New York and Ohio by Mr. G. K. Gilbert; north of Lake Superior by Dr. A. C. Lawson; about Lake Michigan, south of Superior and northeast of Lake Huron by Mr. F. B. Taylor,—this makes our list of workers.

From one strand to another, lower, lower, lower sank the Warren waters, and slowly rose the deserted shores of the great inland sea or lake. But this subsidence of the waters was caused by the rise of the land; not an equal uplift of the continent, but a greater elevation towards the north and east than towards the south and west. The lands about the shrinking lakes were gradually expanding, so as to eventually dismember the Warren water, when it was contracted within the separate basins. At first there were two of these. The greater was Algonquin Lake, covering most of the Superior basin, reaching to near the southern end of the Michigan, to near the southern end of the Huron, and expanding far beyond the eastern margin of Georgian Bay, and extending by a strait northeastward toward the Ontario basin by way of the Nipissing and Ottawa valleys.




MAP SHOWING THE EASTERN PART OF ALGONQUIN LAKE.

The other branch of the dismembered Warren water was an unnamed union, embracing the waters in the Ontario basin and in the Erie basin, to the extent perhaps of a hundred miles from the Niagara River.

The waters at the level of the Algonquin and the lost pre-Erie beach tarried for a long period; but from these levels they gradually sunk, leaving fainter beaches and terraces until a level 300 feet below was reached—the Iroquois beach

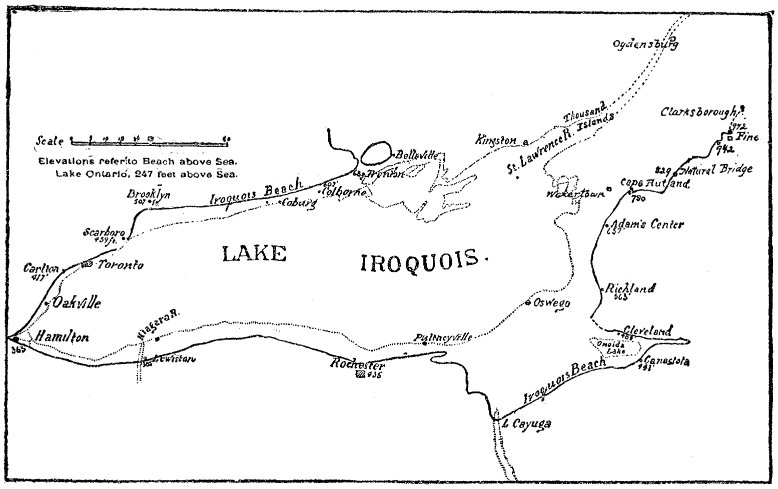
Then Niagara River had its birth. At this level, the

[1] "Deformation of the Iroquois Beach and Birth of Lake Ontario." Am. Jour. Sc., Vol. XL., 1890.
"Deformation of the Algonquin Beach and Birth of Lake Huron."
"High-Level Shores in the Region of the Great Lakes and their Deformation." Am. Jour. Sc., Vol. XLI., 1891.

pause in the terrestrial movement was of long duration. The youthful Niagara drained only the Erie basin, and cascaded over the low Niagara escarpment in a sheet resembling the modern "American Falls."

After a long rest, the continental undulations again became active, so that before long the waters in the Ontario basin sank eighty feet below its present level, and withdrew somewhat from the head of the lake, but they extended far down the Laurentian valley.

The Iroquois shore was formed at sea level. Before the Iroquois episode, the terrestrial warpings had set in, but the deformation was relatively slight. The deformation accompanying the epeirogenic movements following the Iroquois days was much more pronounced. About the head of Lake Erie, the beaches are now nearly level, but at the eastern end the deformation is two feet in the mile; east of Georgian Bay it amounts to four feet, and east of Lake Ontario it reaches five, six or even eight feet or more in each mile. In this Adirondack region, it is not unlikely that the old strands have been more or less dislocated by modern faultings such as occur from the Hudson River southward. Up to the present time we do not know what barriers, if any, closed these inland seas. The lower strands are known to be connected with old marine shore-lines. There may have been some land barriers now unrecognized on account of faulting. Some think that the waters were held in as glacial lakes. Of the eastern region there has been too little exploration for us to know anything about the lakes. But we do know that there were once greater bodies of water where the lakes now exist.




MAP SHOWING THE WESTERN PART OF IROQUOIS LAKE.

During the earlier Niagara epoch, or throughout the Iroquois epoch, the Nipissing strait became lower, and the Algonquin waters slowly subided so that they emptied by a river flowing through the Nipissing basin and the Ottawa valley to the Iroquois lake below. But with the rise of land accompanying the subsidence of the Iroquois waters, below their great beach, the Nipissing rim of the Huron basin was raised so high that the Algonquin lake flooded the head of the Michigan basin, and overflowed what is now the outlet (then the head) of the Huron basin, and drained by the Niagara River.

About this time the eastern rim of the Erie basin was raised up, so that the waters backed up to the present head of the lake, and the barrier at the outlet of Lake Ontario was uplifted so as to back water over the lands at the head of the basin to the extent of eighty feet.

To-day the Iroquois beach rises 363 feet above the sea (the lake is 247 feet). At the eastern end the same beach is 730 feet, and still farther, on the flanks of the Adirondack mountains, this old shore line may be seen in fragments at a thousand feet or more, the whole rising as a monument of the mutability of the most ancient hills of America.

The story of the lakes is still incomplete, and some of the most important questions are not yet settled. But a dozen years of research upon the old shore-lines, whether beaches, terraces or sea cliffs, has begun to throw some light upon the history of the most distinguished feature of the continent. We now know something of the origin of the basins, the birth, maturity and commencement of the old age of the great lakes. Something more of their age will be known when the history of Niagara Falls is written, but its history could not have been deciphered without the present history of the lakes being known.

---

—At the beginning of the present year a meeting was held in London to promote a memorial commemorative of the eminent services of the late Sir Richard Owen in the advancement of the sciences of Anatomy, Zoölogy and Palæontology. It was decided that the memorial should consist primarily of a marble statue, which should be offered to the Trustees of the British Museum, to be placed in the Hall of the Natural History Museum. A large committee, including the names of many foreign and American men of science, was formed to carry out this project, the Prince of Wales being Chairman. The circular-letter sent out has been very liberally responded to, the subscription list amounting on Nov. 1 to £1,050. The number of contributors, however, is relatively small; and it is hoped that a much larger sum will yet be obtained: for Owen was so many-sided in his work that his memory has a claim upon naturalists of every grade all over the world. With a few notable exceptions, a very small number of American names have as yet appeared among the contributors. They have probably yet to be sent, and we would offer the present suggestion that subscriptions from intending donors should be sent with as little delay as possible to the Treasurer of the Fund, Sir William H. Flower, Natural History Museum, London, S. W.

—T. Y. Crowell & Co. have received word that Professor Ely's "Taxation in American States and Cities," published by them, will soon appear in Japanese, the work having been translated by Dr. Iyenaga, one of his former students, and Mr. Shiozawa. Messrs. Crowell & Co. hope to have Professor Ely's new book on "Socialism" on the market in the coming spring.

—James Pott & Co. announce that they have made arrangements with Prof. Henry Drummond to bring out his new work, "The Evolution of Man," being the Lowell lectures for 1893.

SCIENCE:

PUBLISHED BY N. D. C. HODGES, 874 BROADWAY, NEW YORK.

SUBSCRIPTIONS TO ANY PART OF THE WORLD, $3.50 A YEAR.

To any contributor, on request in advance, one hundred copies of the issue containing his article will be sent without charge. More copies will be supplied at about cost, also if ordered in advance. Reprints are not supplied, as for obvious reasons we desire to circulate as many copies of SCIENCE as possible. Authors are, however, at perfect liberty to have their articles reprinted elsewere. For illustrations, drawings in black and white suitable for photo-engraving should be supplied by the contributor. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. It is invaluable to those who use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

## TEXAS CLAYS AND THEIR ORIGIN.

BY W. KENNEDY, AUSTIN, TEXAS.

A SHORT time ago, while engaged in making a report on the clays of the State for the Geological Survey of Texas, I had occasion to study a large number of analyses made of clays belonging to the different Tertiary formations. During the course of the investigations it appeared to me that there was a peculiarity in the chemical composition of these clays not often seen among clays—that is, while in nearly every other clay to the analysis of which I had occasion to refer, and in which the alkalies, potash and soda were separated, the contained potash appears to exceed the percentage of soda, and in some instances this excess appears to be very great. In the Texas Tertiary clays, on the other hand, almost every one of the analyses made shows the soda to exceed the potash in ratios from 2 to 5 of soda to 1 of potash. As this excess varies in the different divisions, the difference generally increasing as we ascend in the beds, while at the same time the actual quantities of both decrease in the same ratio until the highest or coastal clays are reached, when the amounts of both are largely increased, I have been led to the opinion that this peculiarity might be due to the origin of the materials forming these deposits, or that some clue to their source might be obtained by a study of this phenomenon.

With this object in view, I have examined whatever analyses have been available of the deposits underlying or older than the Tertiary within the State, as well as the analyses belonging to the Tertiary and other beds found in the other States, so far as I have been able to obtain them, together with the analysis of the underlying deposits from which the clays may reasonably be expected to have been derived.

In the New Jersey clays, which, according to Cook, are of Cretaceous age and derived mostly from rocks lying to the southeast of the deposits, but which are now covered with water, or else completely destroyed, the percentages of potash and soda are 0.93 potash and 0.10 soda. In Ohio, according to Mr. Orton, the clays derived from the Carboniferous shales show averages of:

| | Potash. | Soda. |
|---|---|---|
| 5. Fire clays, | 0.67 | Traces |
| 8. Potters' clays, | 0.91 | Traces |
| 6. Pipe clays, | 2.82 | 0.26 |
| Or an average of | 0.18 | 0.0137 |

In Kentucky, the next report examined, Dr. Peters shows the averages of the different formations to be:

| | Potash. | Soda. |
|---|---|---|
| 10. Tertiary fire clays, | 0.607 | 0.099 |
| 17. Coal-measure fire clays, | 0.537 | 0.407 |
| 5. Tertiary Potters' clays, | 0.814 | 0.208 |
| 3. Coal-measure Potters' clays, | 2.909 | 0.231 |
| 3. Black slate and Clinton clays, | 4.537 | 0.303 |
| 1. Middle Hudson clays, | 4.660 | 1.706 |

In Arkansas, according to Williams, the shales show the percentages of potash and soda to be:

| | Potash. | Soda. |
|---|---|---|
| At Little Rock, | 1.36 | 2.76 |
| Round Mountain, | 1.81 | 0.66 |
| Fort Smith, | 2.18 | 1.03 |

These shales belong to the Carboniferous, and it may be noted that the shales in the neighborhood of Little Rock are in close contiguity to the syenite area around Fourche Cove. Unfortunately no clay analyses showing the exact relations between the potash and soda in the Tertiary deposits are available from either Arkansas or Louisiana, into which many of the Texas Tertiary beds stretch with unbroken continuity.

Coming back to the fact that the Texas Tertiary clays are sodic clays, it is interesting to note that the immediately underlying deposits of Cretaceous age also carry an excess of potash over soda. The section of these beds appears to be roughly, in descending order, thus:

Greensand marls,
Marly flags,
Ponderosa (blue) marls,
Chalk marls,
Austin limestone.

The published analyses of these deposits show the percentages of potash and soda to decrease as we descend as follows:

| | Potash. | Soda. |
|---|---|---|
| Greensand marls, | 1.75 | 2.94 |
| Ponderosa (blue) marls, | 0.802 | 2.78 |
| Chalk marl, | 0.15 | 2.84 |
| Austin limestone, | 0.23 | 2.34 |
| Average Cretaceous, | 0.733 | 2.72 |

Going still further back in the deposits, the only analyses we have of the clays and shales of the Carboniferous show them to be also sodic and to carry a percentage of 3.09 soda and 1.53 potash, or closely approximating the ratio shown in the Tertiary basal clays and the lignitic beds.

The only analyses we have of the Texas kaolins show the west Texas materials to be practically free from alkalies and the Edwards County deposits to carry 0.02 of potash and 0.60 soda. An analysis of the basalt from Pilot Knob, near Austin, gave Professor Kemp 2.77 soda and 2.02 potash (*Amer. Geol.*, Nov., 1890). A kaolin from Pulaski County, Arkansas, shows 0.23 potash to 0.37 soda.

Clays naturally partake of the nature of the rocks from which they may have been derived, and the proportions of their constituents will in the same manner be in a ratio more or less in accordance with those of the parent rock, the variations being due to the solubility of the constituent and the number of changes to which it may have been subjected during the course of its transportation from the original locality to that in which we may find it. These changes are, however, sometimes extremely great, as, for instance, in the case of kaolin. Williams shows a kaolin in Arkansas, evidently derived from a syenite containing 5.48 potash and 5.96 soda, to have only 0.23 potash and 0.37 soda.

Since, then, the Texas Tertiary clays appear to be sodic,

where are we to look for their sources? Are they due to the destruction of the syenites of Arkansas or the basaltic outbreaks of which Pilot Knob is a representative, or must they be traced to a still more remote source among the eruptive and intrusive rocks of western or central Texas through the media of the Cretaceous, Carboniferous and other stages found in Texas?

Another question may be asked. The Tertiary deposits themselves give strong evidences of their being mostly of marine deposition, having throughout the greater portion of them a marine fauna. Had this condition of deposition anything to do with the quantities of soda found in the beds? Was it deposited from the waters of the sea and afterwards absorbed by the clays? Sodium chloride appears as an efflorescence in many portions of the area. Sodium occurs both as chloride and sulphate in nearly the whole of the mineral waters examined, and even the Greensand marls of the marine beds show, with but few exceptions, a large percentage of soda over the potash.

The few soils examined by the officers of the Geological Survey have also the same apparent constitution. Soda appears to exceed the potash.

It may also be of interest to find that, according to Ditmar, the relation of soda ($Na_2O$) to potash ($K_2O$) in ocean water is 100 to 3.23, and in kelp, according to Richardson, 100 to 5.26.

For geological purposes, the Texas Survey has divided the Tertiary deposits into five divisions, which may be briefly described, in ascending order, as follows:

First: The basal beds or Wills Point clays—This is a series of blue, bluish gray, yellow and brownish yellow clays, and gray, yellow and brown sands. These clays contain numerous small nodules of calcareous material, and crystals of selenite also occur in places. They also appear as fossiliferous in places. Boulders of fossiliferous limestones, with veins of calcite through them, occur scattered throughout the beds, although the heaviest proportion belong to the yellow-sand division—and occasional irregular deposits of heavy bedded white and grayish white highly fossiliferous limestones form a portion of these basal beds. These deposits lie immediately upon the marly deposits of the Upper Cretaceous, and may be said to have been deposited in small bay-like indentations along the Cretaceous shore line, or probably have suffered extensive erosion, as they now occur only as isolated patches in a few places along the Cretaceous border.

Second: The lignitic beds.—These deposits form the lowest portion of Dr. Penrose's Timber Belt beds and comprise a series of blue, brown, yellow, white and gray clays and sands, with extensive deposits of brown coal and lignite. The clays occur as thinly laminated, or stratified and massive, sometimes nearly free from sand; but the greater portion occurs as sandy or micaceous clays. Near the base these deposits consist of blue sands and clays, with occasional beds of gray and pinkish white or gray clays and thin deposits of brown sandstones. At the top they become a series of thinly-laminated and thinly-stratified red and white sands and clays, the laminæ or strata usually not exceeding ¼ to ½ inch in thickness, although the white-clay strata occasionally form beds from four to six feet in thickness. These, however, are very irregular, and when such a thickness of clay occurs it generally forms a pocket-like deposit extending over but a small area. The intermediate beds may be said to be blue and dark gray sands, clays and lignites—the lignites often attaining a thickness of from six to sixteen, and even more, feet. These lignite beds are probably the most extensively developed Tertiary deposits within that portion of the coastal plain in the State. Nor are they confined to Texas alone, but occur farther east in both Arkansas and Louisiana. In the northeastern portion of the State they have a known thickness of 1,000 feet, wells bored in that region from 800 to 1,000 feet having failed to pierce them; and at Mineola, in Wood County, the base of these beds was not reached in a well 1,200 feet in depth. These beds contain vast deposits of clays of all sorts, including plastic potters' clay and refractory clays showing an analysis equal to the best Stourbridge, as well as clays suitable for the manufacture of the finest grades of porcelain.

Third: The Marine beds.—Succeeding the lignitic beds and overlying them in direct continuity comes a series of sands, clays and iron ores, the greater portion of which is highly fossiliferous, containing in many places an abundant marine fauna. These beds have an aggregate thickness of over 600 feet. Abundant deposits of limonite and greensand marls occur throughout them, but the clays are generally poor and very irregularly deposited.

Fourth: The Yegua beds.—The fourth great division has been called the "Yegua clays" from their development on the river of that name. These clays form the base of Dr. Penrose's Fayette Beds, and the division comprises a series of dark blue and gray clays and brown and gray sands and sandy clays, with great quantities of selenite in crystals from nearly six inches in length down to sizes almost microscopic. The water found in these beds is strongly saline, and in many portions of the area underlaid by them, especially where the dark blue clays approach the surface, the gray overlying sands show patches of saline efflorescence. Many of the gray clays belonging to this series contain leaves and stems of plants, and heavy deposits of lignites also occur at many places within the same area.

Fifth: The Fayette Sands.—This division has been called the Fayette Sands chiefly on account of its being made up largely of gray sands and sandstones, although, however, it contains many deposits of very fine white and gray clays, many of which when washed showing decided kaolinitic conditions. These deposits are also more or less fossiliferous, showing at places a scanty marine fauna of the Eocene series, and closely connecting them with the yellow and brown sands of the marine beds already referred to. In the sands belonging to this division great quantities of beautifully opalized wood occur. Beds of a very fine white silicious earth or sinter occur at several places within this area, and the enormous quantities of gray sandstone used at Galveston and Sabine Pass for jetty purposes are obtained from these beds. Many of the clays and coarse sandstones belonging to the upper portion of the Fayette beds are highly calcareous, and in places show small quantities of well-worn Cretaceous shells.

Overlying the Fayette sands there appears a series of heavy-bedded, blue, red, green and yellow and sometimes white clays, with brown and grayish white sands containing small patches of pink clay. These are pretty generally ascribed to the Tertiary age, but their exact position is as yet a matter of doubt. The blue clays contain an abundance of calcareous nodules scattered throughout them, although these nodules appear to be wanting in the immediately underlying red clays, and are not very plentiful in the overlying yellow and green deposits. These deposits have not yet received a specific name. They have been described in the Third Annual Report of the Survey under the title of the Fleming beds. Since then, however, more extended research has been made in these beds in southwestern Texas, and Mr. Dumble proposes to assign to the whole division the name of "Frio Clays."

The last division of our clay deposits is known as the Coastal Clays. These occupy an area of from 75 to 100

miles in width along the coast, and comprise a series of blue, brown, yellow and variously colored clays, many of which are highly calcareous.

With probably the exception of the basal beds, which, as has already been stated, appear to be somewhat irregularly distributed along the contact between the Tertiary and the underlying Cretaceous, the whole of these deposits may be considered as lying in a series of irregular belts roughly parallel to the present coastal line, while a section drawn across them almost anywhere would show each to have an abrupt exposure towards the northwest. In other words, while the dip is approximately southeast, the northwestern edge appears usually as an escarpment showing the broken ends of the beds, and in places these escarpments have deflected the courses of several of the rivers crossing the Tertiary area. These rivers also appear to be working southward, showing high steep bluffs along their southern sides, while broad flat bottom lands appear along their northern banks. Such also appears to be the course of operations with all the larger streams running in an easterly or westerly direction.

A peculiarity noticeable among the lower divisions of these deposits is a flexing or bending of the beds, beginning in the lignitic, and, so far as at present known, reaching the culminating point towards the top of the marine beds. This flexing has resulted in making many of the higher hills hills of erosion and the tops portions of the synclines.

From this brief outline it will be seen that the greater portion of the Tertiary areas is made up of extensive beds of clays and sands.

The analyses of these clays made by the different chemists of the Geological Survey show them to have the peculiarity of having the proportions of the alkalies potash and soda reversed. In the greater number of clay analyses which I have had occasion to refer to, the proportion or percentage of potash exceeds that of the soda. In the Tertiary clays of Texas the proportions of soda exceed the potash as 3.19 of soda to 1.18 of potash. These proportions vary in the different stages, as will be seen in the following:

| | Potash. | Soda. |
|---|---|---|
| 1. Basal beds, - - - - - | 1.53 | 3.64 |
| 2. Lignitic beds, - - - - - | 1.35 | 3.42 |
| 3. Marine beds, - - - - - | 0.91 | 2.32 |
| 4. Yegua beds, - - - - - | 1.07 | 2.33 |
| 5. Fayette beds, - - - - - | 0.67 | 1.93 |
| 6. Fleming (Freo) beds, no analyses made. | | |
| 7. Coastal clays, - - - - - | 1.56 | 5.52 |

From this it will be seen that there is a gradual decline of the two alkalies as we ascend until the coastal clays are reached, when the soda shows a sudden increase over the basal beds almost equal to the sum of the losses it sustains in the other members of the series, while its actual increase over the Fayette beds amounts to 3.55. The potash also shows an increase in these beds over the basal clays of only 0.03, and over the Fayette beds of 0.88, or about equal to the sum of the losses sustained in its course through the deposits from the lignitic to the Fayette.

The question of the origin of these clays involves the existence of an extensive land area of deposits in which the alkalies were strongly represented, and, assuming the solubility of the two to be approximately similar (as a matter of fact the potash is slightly more soluble), one in which the soda was considerably more abundant than the potash. Again, throughout the deposits and interbedded with the clays we have heavy beds of sand, many of them almost pure quartz, and the greater portion of the clays themselves are highly silicious. In addition, the immense deposits of limonite found interstratified with and covering the marine stage of these deposits will require to be accounted for.

It appears to me that the most probable immediate sources of the materials entering into the composition of these Tertiary deposits are the underlying cretaceous beds for the lowermost or basal Tertiary, and a partial reworking of the older Tertiary with the cretaceous materials for the upper or newer deposits. These cretaceous marls and marly clays correspond very closely to the Tertiary deposits, as will be seen from the following analyses:

| | I. Av. of 59 Tertiary Analyses. | II. Av. of 8 Cretaceous Analyses. | III. |
|---|---|---|---|
| Silica, - - - | 65.63 | 31.67 | 59.34 |
| Alumina, - - - | 14.84 | 9.92 | 18.59 |
| Iron, - - - | 4.83 | 3.36 | 6.30 |
| Lime, - - - | 3.19 | 26 68 | 3.19 |
| Magnesia, - - - | 0.30 | Trace | Trace |
| Potash, - - - | 1.03 | 0.73 | 1.37 |
| Soda, - - - | 2.65 | 2.72 | 5.01 |
| Carbonic acid, - - | —— | 20.95 | —— |
| Sulphuric acid, - - | 0.57 | 1.04 | 5.67 |
| Water and loss, - - | 7.11 | 2.97 | .57 |
| | 100.15 | 100.04 | 100.04 |

The third column shows the average of the Cretaceous analyses re-calculated without the carbonate of lime and carbonic acid and omitting a portion of the sulphuric acid, which would undoubtedly be lost during the course of erosion and deposition, and which we might expect to find farther to the south among the more recent of the Tertiary deposits as well as in the coastal clays. The percentages of lime and sulphuric acid shown in this analysis are the averages shown in the Tertiary deposits. The course of the lime through the different sets of beds appears to be thus:

| | |
|---|---|
| Basal beds, - - - | 2.05 |
| Lignitic beds, - - - | 0.77 |
| Marine beds, - - - | 1.97 |
| Yegua beds, - - - | 0.43 |
| Fayette beds, - - - | 10.75 |

Many of these Fayette clays contain as high as 24.42 per cent of lime and 18.91 per cent of carbonic acid. Among the sandstones belonging to the upper division there are many beds which might be classified as calcareous sandstones, some of them containing enough lime to have made it profitable at one time to use them as a source of lime for building purposes. Their derivation from Cretaceous deposits is also indicated by the existence of numerous water-worn Cretaceous shells.

The coastal clays contain immense quantities of lime at different points, and nothing short of an immense number of analyses could give us anything like a fair average. They have not been included in any of the above analyses.

The basal beds of the Tertiary so strongly resemble the upper and contiguous beds of the Cretaceous in lithological as well as chemical structure that it is very difficult to tell them apart, and in many portions nothing but a study of the fauna will enable anyone to differentiate the two, and in many places the Tertiary beds contain boulders and fragments of Cretaceous limestones containing Cretaceous fossils.

It would thus appear that the structural conditions of the Basal beds and the Fayette deposits, apart from any chemical evidence whatever, bears out the assumption of these two divisions being derived from the Cretaceous. If we accept Dr. Penrose's theory that the iron ores and glauconite of the marine beds are largely due to the destruction of the upper glauconitic division or the greensand of the Cretaceous, and in this theory, from a long period of work among these beds, I am inclined to believe for several reasons—one of which being the close affinity chemically and otherwise of these beds. Then that will in

a great measure dispose of the origin of the middle great division.

Now whether the great series of deposits immediately overlying the marine beds—the Yegua clays—have been altogether derived from the erosion and consequent destruction of the marine beds is not very clear. That a portion of the materials composing these clays was so derived there can be no doubt. The line of contact between the two is very irregular in more than one place, showing long troughs or valleys of erosion in the older beds, and now filled up by the clays and sands of the newer. At other places this outline shows the existence of comparatively bold head-lands, from which no doubt the waters of Yegua time abstracted a considerable quantity of material. The presence of extensive deposits of lignites in these beds would appear to indicate another source of material having a swamp or lagoon origin, and some of it may have been obtained from the rivers traversing the region. Some of the materials employed in the formation of these beds may also have been derived from the sea water occupying the area during the period of deposition.

The last division, or more properly speaking, the second division—the lignitic beds—presents somewhat different features from any of the others. So far as it contains immense deposits of lignite and small beds of sand carrying crystals of selenite, it resembles the Yegua clays, but with that its resemblance ceases. The beds belonging to this division overlie the basal deposits, which in many places they overlap so completely as to obscure them altogether, and in others lie in direct contact with the Cretaceous deposits. Throughout the whole of the immense thickness and extent of these beds, with the exception of a few fragmentary plant remains, some of them belonging to the *sabal* family, not a single fossil is known from this division. Evidently the conditions were not favorable to animal life.

These beds apparently represent a period when the whole coast was made up of swamps, lagoons and bayous, very similar to some portions of the gulf coast of the present day, or what may be seen in the broad stretches of overflow or "bottom" land found along almost every one of our rivers. A rank vegetation grew on the marshy portions, and the rivers of the time having no fixed channels, distributed their waters throughout the lagoons and bayous and into them, and over the low islands carried their burdens of debris during periods of flood. With this debris came soft clay, sand, branches, limbs and trunks of large trees, all of which went to swell the accumulations already gathering and aid in the formation or the lignites and their associated beds of clay and sand. In the meantime the coast was slowly sinking and the encroaching water eating away the basal clays and the Cretaceous deposits within reach.

The lithological structure of these deposits accord with these conditions. Everywhere the deposits are irregular in deposition, variable in texture, changing from fine-grained, dense, muddy, to coarse-grained, sandy material within short distances. Many of the beds contain great quantities of iron pyrites, a common characteristic of the Cretaceous greensand marls. In composition these lignitic beds closely resemble these marls.

| | IV. Av. of 38 analyses of lignitic clays. | V. Cretaceous greensand marls. |
|---|---|---|
| Silica, | 69.83 | 60.82 |
| Alumina, | 16.93 | 16.05 |
| Iron, | 3.66 | 5.25 |
| Lime, | 0.77 | 3.66 |
| Magnesia, | 0.35 | |
| Potash, | 1.35 | 1.75 |
| Soda, | 3.42 | 2.94 |
| Sulphuric acid. | 0.22 | 1.06 |
| Carbonic acid, | | 2.85 |
| Water and loss, | 4.26 | 5.53 |
| | 100.79 | 99.91 |

From this, then, it would appear that while the greater portions of these clays and sands are derived from Cretaceous materials, these have been mixed with a small quantity of ingredients belonging to some of the older formations through which the larger rivers ran; but the proportions of these older materials were so small as not to visibly affect the deposits as a whole.

Mention has been made of the syenitic rocks of Arkansas and the basaltic outbreaks extending through the Texas Cretaceous area as forming the source of some of the materials found in the clays. These I do not think can have contributed any of the materials required. No very decided evidence of the age of these rocks has been given, but the general opinion as stated by Branner and Williams appears to be that the age of the Arkansas rocks is ether late Cretaceous or early Tertiary, and certainly not newer than this time. According to Hill, Pilot Knob belongs to the upper Cretaceous and the latter half of Austin Chalk sub-epoch. If these ages are accepted, then certainly the rocks in question had nothing to do with the formation of the Texas Tertiary clays.

## KARYOKINESIS IN EMBRYOS OF THE DOMESTIC CAT.—PRELIMINARY NOTICE.

BY FRANK S. ABY, HISTOLOGICAL LABORATORY, STATE UNIVERSITY OF IOWA.

In all sections of various embryo kittens that have been examined by the writer, up to those of embryos seventeen millimetres in length, karyokinetic figures are by no means an occasional or a rare occurrence, but are to be found in many situations.

In the preparation of these sections, no special cytological methods were employed, as the subject of investigation was the development of the central nervous system of the cat. The embryos were hardened in increasing strengths of alcohol, with no precautions whatever with regard to fixation. After remaining in 95 per cent alcohol for a number of months the embryos were imbedded in celloidin and sectioned. The sections were then stained in Grenacher's haematoxylin and mounted in Canada balsam.

The resting nuclei are spheroidal occasionally, but the more usual form is that of an elongated oval. Occasionally very peculiar, irregular nuclei are found, and one was seen whose length was three times its width, without the aggregation of chromatin to be described later, but with a clearly marked reticulum and nuclear membrane. Usually the nuclear membrane is not shrivelled or wrinkled in hardening, but is plump and distinct, clear cut on its outer line, and in almost all cases has taken a deep stain.

The chromatin in these resting nuclei is disposed in a reticulum that strongly reminds one of the bridles seen in plant cells. This reticulum is clearly continuous with the nuclear membrane, as may be seen in very numerous instances, the point of union of a strand and the nuclear membrane presenting a well-defined enlargement of the strand. In some nuclei which happen to lie in the proper position several of these points of union in a single nucleus appear in the same plane, giving the nuclear membrane the appearance of being toothed.

Occasionally a nucleus is found in which all that is to be seen within the nuclear membrane is this reticulum, without local aggregations of the chromatin. In the greater number of nuclei the chromatin is so disposed that certain local thickenings may be observed. Under a power of about 500 diameters these accumulations of chromatin appear to have no connection with the nuclear membrane, but each nucleus seems to have a well-defined nucleolus. Under a power of 1,200 diameters, however, the connection between the strands of the reticulum and this central body stand out clearly. This aggregation of chromatin may be condensed, and in some instances may be described as spheroidal; in other more numerous instances it is elongated, and, with its radiating strands of the reticulum, looks very much like a bone lacuna, with rather coarse canaliculi. Usually but one such body is found in a nucleus; but occasionally there are two side by side, or both near the nuclear membrane, and it is not rare to find four or five. From the behavior of these local aggregations and the strands of the reticulum to haematoxylin, it is not possible to determine a difference. Both have about the same tint, and any slight difference of shade may be attributed to the quantity of colorable matter present in the aggregations.

In situations where it is to be supposed that cell multiplication is proceeding rapidly, as in the Wolffian bodies and the inner lining of the cerebral vesicles and central canal of the developing cord, many nuclei are found whose nuclear membranes are indistinct, in many cases invisible. Those nuclei, however, are quite conspicuous, owing to the fact that the chromatin is no longer disposed in thin shadowy strands, but is in heavy solid skeins, taking a much deeper stain than any part of the resting nuclei. Moreover, these deeply staining bodies of chromatin in these nuclei assume the position of the nuclear membrane that has disappeared, thus forming a basket with irregular meshes. Thus far I have not been able to determine whether in these nuclei it is a single skein, or a number of segments, that enter into the formation of this basket; but in certain nuclei, where the basket was not very regular, detached segments were certainly determined. In some nuclei in which mitosis was well established the loops of chromatin, or chromosomes, were seen scattered through the nucleus, as if the basket had been broken into fragments and crushed in. No traces of the nuclear or achromatic spindle were observed before the monaster stage.

The monaster stage was seen in many nuclei, but the best view was always obtained when the achromatic spindle was lying at right angles to the line of vision. When the aster was seen from the pole the chromosomes were in such a tangle that no satisfactory view was obtained. In the nuclei of embryo kittens the chromosomes are short and thick, and in the haematoxylin employed took a very deep stain, in many cases almost black. For these reasons it was usually impossible to distinguish individual chromosomes in either the monaster or dyaster stage, but the ends of the chromosomes were usually distinct.

The achromatic spindle at this stage is fairly conspicuous and well defined. The chromosomes are seen clustered in the plane of the equatorial plate, while on both sides the fibrils of the achromatic spindle converge toward the pole corpuscle. From the region surrounding the pole corpuscles, radiating out into the cytoplasm, are to be seen the exceedingly delicate rays of achromatic substance, forming the polar cones. Many nuceli were seen at this stage presenting the appearance of the conventionalized diagrams, such as Quain's "Anatomy," tenth edition, vol. I., part II., figure 214, except that the chromosomes were not so distinct as in the diagram.

In the process of metakinesis all phases were seen, from that in which the limbs of many chromosomes remained in contact, while the apices of the loops had separated, to the complete dyaster stage. In some instances the ends of the limbs of two or four chromosomes remain in contact, the others having separated. In nuclei in which the two sets of chromosomes have migrated for some distance, and are separated by an interval equal to the average diameter of a resting nucleus, the exquisitely fine webs that stretch from the ends of the limbs of one set to the ends of the limbs of the other set may be seen in many instances. When the two sets are separated by a small interval the web is not easily seen.

In the dyaster stage the two sets of chromosomes do not present the appearance that is usually represented. As stated before, the chromosomes of the cat are short and thick, and the limbs do not extend in such a way as to make it easy to determine their number. It is stated that the nuclei of each species contain a definite number of chromosomes. From what can be determined in the nuclei under observation, each set of chromosomes in the dyaster stage contains four chromosomes, although it is difficult to determine this point with certainty.

The portion of the achromatic spindle between the pole corpuscles and the two sets of chromosomes can be made out easily, as the delicate webs are quite conspicuous in the dyaster stage, and seems to take a deeper stain in many instances than in the monaster stage. I am not certain that the webs of the spindle react to haematoxylin, but am certain that in some instances this seems to be the case. The radiating webs beyond the pole corpuscles, extending out into the cytoplasm and forming the polar cones, have not been made out in the dyaster stage.

The chromosomes in the two-daughter nuclei, then, assume the basket form. The baskets found in the two-daughter nuclei are easily distinguished from the basket in the initiatory stage of karyokinesis by the fact that daughter nuclei occur in pairs, and each basket is much smaller than that found in the mother nucleus. The meshes in daughter nuclei are also much smaller, and the chromatin is in a close tangle.

Of all the stages of karyokinesis in these nuclei, the dyaster stage is most conspicuous and most easily found. Mitotic figures are most abundant in embryos about five millimetres in length; in older embryos they are not so easily found. In examining sections from a five-millimetre embryo, some fields show karyokinetic figures in fully half the nuclei.

In these embryos karyokinesis was observed in the following situations:

I. Lining of primitive cerebral vesicles. Here they were most abundant. Nuclei bounding the cavity showed the figures especially well.

II. Lining of central canal of the spinal cord. Here also very abundant.

III. Lining of lumina of tubules of Wolffian bodies. Occasional.

IV. Epithelium lining the pharynx.
V. Within the branchial arches.
VI. Epithelium lining the branchial clefts.
VII. Optic vesicles.
VIII. Otic vesicles.
IX. Epiblast forming epidermis of face.
X. Walls of heart.

## THE PTERYLOGRAPHY OF THE PILEATED WOODPECKER (*CEOPHLOEUS PILEATUS*).

BY HUBERT LYMAN CLARK, PITTSBURG, PA.

A recent examination of a pair of Pileated Woodpeckers (*Ceophloeus pileatus*) from West Virginia showed that in several important particulars this species differs in its pterylosis from any of the plates which have been published hitherto, illustrating Picine pterylography. So far as I can learn the pterylosis of Ceophloeus has never been described, or at any rate figured, and so I venture to offer this contribution to a little known branch of ornithology. Nitzsch has figured, in his "System der Pterylographie," *Picus viridis*, and Dr. R. W. Shufeldt has figured and described (*Auk.*, April, 1888) *Dryobates V. harrisii* and *Sphyrapicus V. nuchalis;* but I have seen no other illustrations of the Pici. I have examined *Dryobates pubescens*, *Centurus caroliniensis* and *Colaptes auratus*, but Ceophloeus differs from all these in several ways. A comparison of Fig. 1 with the figure of *P. viridis* (Sys. Pter., Plate V, Fig. 14) shows two very important differences; one of these is on the chin and lower mandible, the other is at the opposite end of the body near the anus. The whole lower surface of the head in *P. viridis* seems to be fully feathered, while in Ceophloeus there are very distinct apteria along the

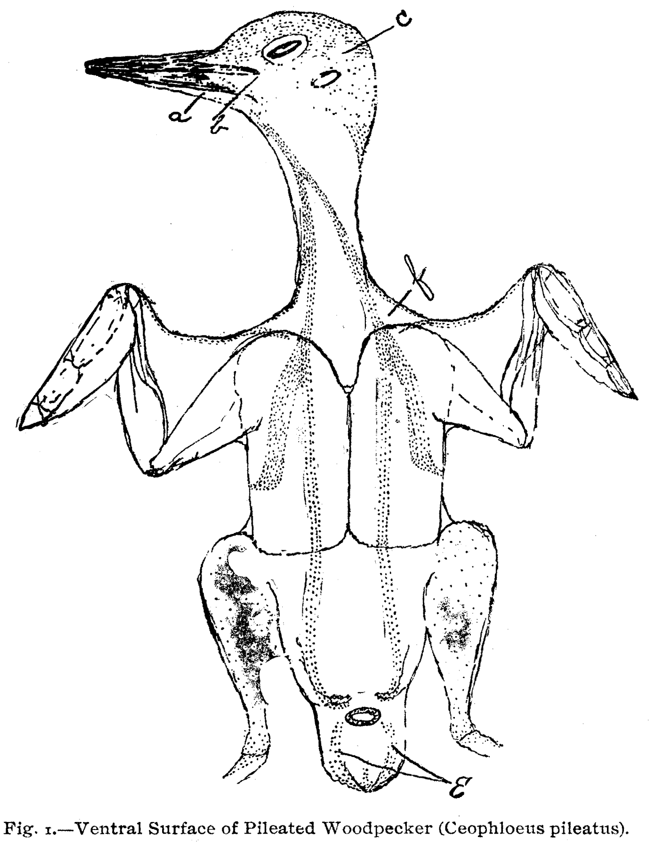



Fig. 1.—Ventral Surface of Pileated Woodpecker (Ceophloeus pileatus).

rami of the lower mandible and on the cheeks. These apteria are not shown in any of Dr. Shufeldt's figures, nor have I observed them in any other woodpecker; but they are very evident in both sexes of Ceophloeus. Fig. 3 shows them nearly natural size; *a*, the apteria of the rami, and *b*, the apteria of the cheeks; the same in Fig. 1, *a* and *b*. Nitzsch says, in regard to apteria on the head, after mentioning the temporal space (see Fig. 1, *c*) and the vertical space (Fig. 2, *d*), "Die übrige Kopfläche ist dicht befiedert," but he seems to have been wrong. According to the same writer, in *P. viridis*, the main branches of the pt. ventralis continue beyond the vent, including it, to the very base of the rectrices; but in Ceophloeus they curve abruptly inward and end just before reaching the anus, while behind the latter is a horse-shoe shaped tract (Fig. 1, *e*) which is also shown in Dr. Shufeldt's figure of *D. v. harrisii* and to which he gives the name of "post-ventral tract" (pt. postventralis). This tract is found in all the four genera of woodpeckers which I have examined, but Nitzsch does not speak of it, although he gives *P. auratus* and *P. carolinus* as among the species he studied. It seems to be wanting in Sphyrapicus, as it is not shown in Dr. Shufeldt's figure of that species. The remainder of the ventral

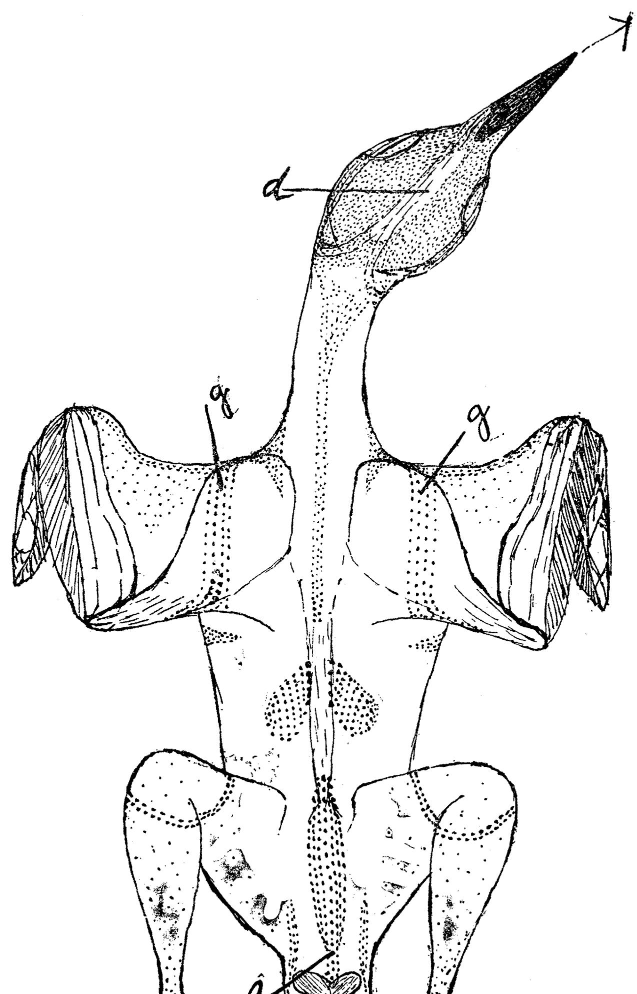



Fig. 2.—Dorsal Surface. Pileated Woodpecker (Ceophloeus pileatus).

surface of Ceophloeus agrees very well with that of *P. viridis*, especially in the connections of the pt. ventralis with the pt. humeralis and pt. alaris forming the triangular apterium shown at *f*, Fig. 1.

On the dorsal surface Ceophloeus agrees with *P. viridis* more nearly than with any other species. The only differences of note are in the humeral tracts and at the extreme end of the dorsal tract. According to Nitzsch's plate, the humeral tracts are much broader anteriorly, but in Ceophloeus (Fig. 2, *g*) they consist of four rows of contour feathers throughout, and so are of equal width at the ends. In *P. viridis* the dorsal tract is of greater width at its end on the oil-gland than it is further forward, while in Ceophloeus it is much narrower there (Fig. 2, *h*). The dorsal surface in Colaptes is on much the same plan, but the tracts are broader,

and there are some noticeable differences. The tail, as is usual in woodpeckers, consists of twelve rectrices, of which the middle pair are the longest, and the outer pair are not only very short, but they are inserted almost over the pair next to them, and are much less stiff and pointed than the others. On the wing I found ten primaries and eleven secondaries and four feathers in the alula. Of the secondaries the first seven are of

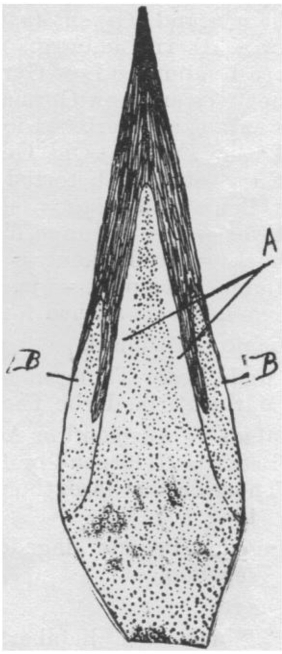



Fig. 3.—Chin and Throat. Pileated Woodpecker (Ceophloeus pileatus). To show the apteria on the lower mandible.

about equal length, and the rest decrease rapidly, the eleventh being the shortest, though it is interesting to note that it is longer than the first primary. No sexual differences were noted in the pterylosis until I examined the proportionate lengths of the primaries, when I was astonished to find a difference which seems well

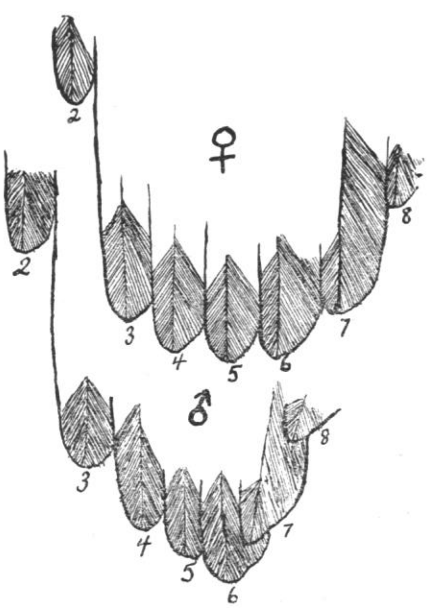



Fig. 4.—Wings of Male and Female.

worthy of note. Of course it must be remembered that I examined only one specimen of each sex, and so this difference may be only an individual variation, but it is so great as to warrant its illustration. In Fig. 4 will be seen the tips of the wings as they appeared in each sex, and the difference in shape will be at once remarked. In both the first primary is very short, only one-quarter the length of the sixth; the second is considerably longer, reaching, in the male, to within two and one-fourth inches of the tip, and in the female to within one and three-fourths inches; the third is next in both sexes, but is three-fourths of an inch shorter than the sixth in the male and less than one-fourth of an inch in the female; the fourth is almost equal to the fifth and sixth in the female, but in the male is shorter than the seventh; the latter in the female is much shorter than the third; in the male the eighth, ninth and tenth are all longer than the second, while in the female the latter is longer than the ninth and tenth. Thus we see that the wing formula in the two sexes is as follows:

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Male, | - | 6 | 5 | 7 | 4 | 3 | 8 | 9 | 10 | 2 | 1 |
| Female, | - | 5 | 6 | 4 | 3 | 7 | 8 | 2 | 9 | 10 | 1 |

It is hardly necessary to state that both wings showed these same differences, which Fig. 4 will make clear.

Aftershafts are present on all the contour feathers, and are of fairly good size though rather weak. The oil-gland is ornamented with a large tuft of white feathers in marked contrast to the surrounding black. Down-feathers seem to be wanting, though "half-down," as Nitzsch calls it, is present on most of the spaces. Filoplumes are plenty on all the tracts.

Figs. 3 and 4 are drawn three-fourths natural size, and Figs. 1 and 2 are not quite one-half.

## SECRET LANGUAGE OF CHILDREN.

BY OSCAR CHRISMAN, A. M., FELLOW IN CLARK UNIVERSITY, WORCESTER, MASS.

**We adults are rather apt to rate children's powers too low. This, no doubt, comes from a lack of study of these powers, and, perhaps, from a wrong comparison of the child with the adult. In the power of originating it may be that the child is the superior of the adult. This is well illustrated in the forming of languages. In this field the child seems to be perfectly at home, as may be shown to any one who will make a study of such; or if he will look back into his own childhood he will find left in memory traces of such languages, or if one will keep his ears open among children he will be very sure to find such languages here and there. Only on the other Sunday afternoon, while, with my wife and little girl, stopping at a small depot on a railroad in South Worcester to rest from a walk, a number of pretty tough-looking boys came along and stopped to play. At first, from their language, I thought they were foreigners, but I soon found out that they were using a language of their own. I did not have the opportunity at this time to make inquiries about their language, for which I am truly sorry.**

**The editor of "Am Ur-Quell,"* a German Folk-Lore paper, gives over 150 specimens of Secret Languages collected during the past three years. To be sure, quite a number of these are not languages of children, as some are of thieves, peasants, secret societies, etc., but who knows but that many of these may have their foundation in child-languages?[1]**

*I am indebted to Dr. A. F. Chamberlain, Lecturer in Anthropology, Clark University, for having my attention called to these languages in Am Ur-Quell, and also for the privilege of using his numbers of this journal.

[1]I am indebted to Mr. L. N. Wilson, Clerk of Clark University, for his having called my attention to the following: " . . . . he went on to mention the one sole accomplishment which his sons had imported from Winchester. This was the Ziph language. . . . . Repeat the vowel or diphthong of every syllable, prefixing to the vowel so repeated the letter G. Thus, for example: Shall we go away in an hour? This in Ziph becomes: 'Shagall wege gogo agawagay igin agan hougour?' "—"The Collected Writings of Thomas de Quincey, New and Unabridged Edition," by David Mason. Edinburgh, 1889, vol. I., p. 202.

In this list I find "Gibberish," "The Black Slang," "The Rhyming Slang," "Medical Greek," "Potters' Latin," "Dog Latin," "Robber Language," "Goose Language," "Crane Language," "Zither Language," "Bob-Language," "Erbsen-Language," "Sa-la-Language," "Schu-Language," "If-Language," "B-, P-, W-, O-, M-, and F-Languages."

There are many other names besides these. These names, in some instances, seem to be simply arbitrary, but many arise from the use of the languages or from some distinguishing features. "Medical Greek" takes its name from its being used by medical students. "Robber Language" derives its name from the fact that the children use it in playing that they are robbers. The B-, P-, etc.,-Languages are so called because the letter occurs frequently in the designated language.

That these languages are quite numerous and variously named is shown from there being in "Am Ur-Quell" more than eighty different kinds named. Twelve of the letters of the alphabet are used as names of these languages, and every letter of the alphabet, except X and Y, is used either as a name or to begin a name among these alphabets.

I shall not go into details concerning these different languages, but give some few examples:

1. B-Language.
   Gubuteben morborgeben.
   (Guten morgen.)
2. P-Language.
   Gupupen mopopen.
   (Guten morgen.)
3. W-Language.
   Guwuwen momowen.
   (Guten morgen.)
4. O-Language.
   Jadakokkebob = Jacob.
5. F-Language.
   (1) Derererfer Baumaumafouun ististafist grnüünafün. (Der Baum ist grün.)
   (2) Wennfenenefes donefoch enefendlinefich frühnefülinefing wünnefürdenefe. (Wenns doch endling Frühling würde.)
6. Ubbala Abbala Language. (Copenhagen.)
   Nubbala ebbala jebbala abbala skribbala, übbala leibbala.
7. Rst.-Language. (Copenhagen.)
   Ereseteldgarasatamlarasata Irisitisarasataforosotold.
   (There are no translations given to these two specimens.)
8. Sa-la-Language.
   The writer of this article in "Am Ur-Quell," G. Schlegel, says he found this language among the Chinese children in Amoy in 1858.
   Goasoa kasa lisi kongsong, or, Goaloasoa kalasa lilisi konglongsong. [Goa (I) ka (to) li (you) kong (say)].
9. Robber Language.
   (Used among the children in Guben (Niederlaus).
   Ein fein le fein gu hu le fu tes hes le fes wort hort le fort fin hin le fin det het le fet ei hei le fei nen hen le fen gu hu le fu ten hen le fen ort hort le fort.
   (Ein gutes Wort findet einen guten Ort.)
10. Potters' Latin.
   Used by school-children of Danzig and Königsberg. Each consonant is placed before and after a short *O*; the vowels remain single.
   Frischbier=fof ror i schosch bob i ror.
11. Dog Latin.
   The speech of a little child just learning to talk is termed by some Dog Latin. Dog Latin was, perhaps, though first used, says the writer, as a term of reproach to designate a language, made up by the ancient merchants of Nievenhagen and Groenstraat, two villages in Southern Limburg. The root words are Limburger Low German; the connectives are Low German; but the substantives and verbs are foreign--Hebraic, Latin, French, Old German—but for the most part distorted and corrupted.
   Benk und blag = Mann, thuren = Frau, wuiles = Junge, flitsj = Mädchen, hock = Kredit, keut = Bier, plinten = Lumpen, sipken = ja, nobis = nein. The numbers all had foreign names.
12. Crane Language. (Denmark.)
   (1) Mads Peder Thomsen.
   Marbe Perbe derbe Thorbe serbe.
   (2) Mads = Adsmand or Adsmaj.
   Peder = Ederpend or Ederpej.
   Thomsen = Omsenthond or Omsenthag.
   3) Magedos Pegede degeder Thogedom ) segeden.
13. Goose Language.
   Ichicherfich liebiberfieb dichicherfich ausauserfaus Herzerzerfersgrundunderfund, wieieerfie derererfer Ochsocherfochs dasaserfos Heueuerfeubundunderfund. (Ich liebe dich aus Herzensgrund, wie der Ochs das Heubund.)
14. Language of the Cat's Elbow.
   Dod is e kok a tat zog e lol a ssass tot dod a sos mom a u sos e non non i choch tot.
   (Die Katze lässt das Mausen nicht.)

In "Songs and Games of American Children," by William Wells Newell, I find the following languages:

1. Gibberish (Hog Latin in NewEngland.)
   Wiggery youggery goggery wiggery miggery?
   (Will you go with me?)
2. Withus yoovus govus withus meevus?
   Ivus withus govus withus yoovus.
   (Will you go with me? I will go with you.)
3. Uwilla uoa ugoa uwitha umea utoa uluncha? (Will you go with me to lunch?) (From Cincinnati.)
4. Cat Language.
   This is the name of a language invented by children living near Boston, and was used mostly to talk to cats. The various positions of the cat were noticed and names given to such. This language seems to have been quite independent of the children's ordinary language.

One afternoon of last year in Texas one of the younger school-boys said to me: "I can talk so that you cannot understand me; I can talk Tut." This was recalled to me one day this winter, and I wrote to a young High School girl[1] of that town to gather for me what she could in re-

[1] Miss Edith Fly, Gonzales, Texas, to whom my thanks are due for such kindness.

gard to this language, and from her work I am able to give the following:

Tut Language.

The name is usually given as Tut Language, but it is also known as Hog Latin and Dog Latin. It consists of an alphabet, which will be given farther on in connection with some others. The way to learn the language is to get the alphabet and then replace the letters of a word with those of the Tut alphabet. Thus:

apple = a–pup–pup–lull–i.
boy = bub–o–yek.

At one time this Tut Language was used by many of the children of the town, but at present it is not used except very slightly. The children knew it so well that they could talk and write it as well as they could their regular language. They were able to carry on as extended a conversation as they desired, and any one unacquainted with Tut Language could no better understand what was being said than if it were a foreign tongue.

The following may be of some interest:

1. Declension of *I* in Tut.

| | Sing. | Plu. |
|---|---|---|
| Nom. | I | wuv–e |
| Poss. | mum-yek | o–u–rur, or, o–u–rur–suss. |
| Obj. | mum–e | u–suss. |

2. Declension of *ox.*

| | | |
|---|---|---|
| Nom. | o–x | o–x–e–nun |
| Poss. | o–x–suss | o–x–e–nun–suss |
| Obj. | o–x | o–x–e–nun |

3. Comparison of *good.*

| | |
|---|---|
| Positive, | gug–o–o–dud |
| Comparative, | bub–e–tut–tut–e–rur. |
| Superlative, | bub–e–suss–tut. |

This young lady traced the origin of Tut Language as follows: She learned it from her mothor's servant, a negro girl, this girl learned it from a negro girl who got it at a female negro school at Austin, Texas, where it was brought by a negro girl from Galveston, Texas, who learned it from a negro girl who had come from Jamaica. Whether it originated in the Island of Jamaica or was carried there I cannot state, as inquiries were able to be made no further than the above.

Perhaps the most striking thing in this language is its close resemblance to the alphabetic languages given in "Am Ur-Quell." These are "Guitar Language," from Bonyhad, Hungary, "Bob Language," from Czernowitz, Austria, and "A–Bub–Cin–Dud Language," from Bergischen. I give here the four alphabets for comparison:

| | Guitar. | Bob. | A–Bub–Cin–Dud. | Tut. |
|---|---|---|---|---|
| a | a | a | a | a |
| b | bop | bob | bub | bub |
| c | (z) zitt | cit | cin | cut |
| d | dot | dot | dud | dud |
| e | e | e | e | e |
| f | finf | fif | fimpf | fuf |
| g | g'wek | gwek | guch | gug |
| h | her | hir | hach | hush |
| i | i | | | i |
| j | jot | jot | j | jug |
| k | kwiss | kweis | kuck | kam |
| l | lol | lol | lol | lul |
| m | mom | mom | mom | mum |
| n | non | non | non | nun |
| o | o | o | o | o |
| p | pop | pop | pop | pup |
| q | (k) kwiss | (k & w) kwisu | ku | q |
| r | ror | ror | ror | rur |
| s | sis | sos | sis | sus |
| t | tot | tot | tut | tut |
| u | u | u | u | u |
| v | (w) vop | vov | vemp | vuv |
| w | | wow | wuf | wuv |
| x | (ks) kwissis | (k & s) kwissos | iks | x |
| y | | i,p,s,i,l,o,n | ypsilon | yec |
| z | | zit | zausis | zuz |

The Guitar Language, so writes the relator, was used sixty years ago by the pupils of a school at Bonyhad, and this party was so expert in its use at that time as to be able to recall it and write it now. The Bob Language was used at school when the writer (in "Am Ur-Quell") was a pupil. The one who gives an account of this A–Bub–Cin–Dud Language states that he found the alphabet among some old scraps of paper at his home, but he is not able to say whether this was ever used at his home (Bergischen) or not.

As I stated at the first, if one will go back into memory he will find traces remaining of these child languages. In my own experience I recall three such as occurring in my boyhood days at my home at Gosport, Ind.:

1. Wilvus youvus go with usvus? This comes ringing in my ears as though it were only but yesterday since I used it.

2. Also we boys had a language in which we turned the words around, as: boy = yob. Thus if a boy got very much vexed and wanted to be expressive, he said "mad-dog."

3. I recall, too, that at one time some of us boys undertook to make up a language. I cannot give anything more of this, as it comes to me only as a faint recollection. I am quite sure, though, that this language was not carried very far nor ran very long.

4. I recall, also, a language used by some pupils in a school in Indiana, in which I taught some years ago. This was a number language. Each letter of the alphabet had a number to represent it, as: a = 5, c = 9, t = 10, etc. Thus: cat = 9–5–10.

This paper is not meant to be exhaustive, but only to give a peep into an unexplored field of child life. It is to be hoped that some day we will become much better acquainted with our boys and girls than we are now.

## PARASITISM OF MOLOTHRUS ATER.

BY CHAS. W. HARGITT, PH. D., SYRACUSE UNIVERSITY, SYRACUSE, N. Y.

Of the few members of our avi-fauna known to be addicted to the habit of parasitism, none is perhaps more thoroughly confirmed therein than the common cow-bird (*Molothrus ater*). This habit is so well known that no particular attention need be called to it as a record of fact or as a matter important for general information. The purpose of this note is simply to record some interesting observations recently made in reference to a host which, so far as my own observations have gone, has not been generally considered as involved in its mischievous usurpations, though Wilson (Am. Ornithology, vol. I., p. 289) mentions it as of the number liable to such impositions.

Upon two occasions during the present summer I have noted the very ludicrous spectacle of the full-grown young of the cow-bird being fed by the chipping sparrow (*Spizella socialis*). One of these observations was made on one of the hottest days of July, and the diminutive little foster-mother panted with mouth wide open as she sought food to satiate the rapacious appetite of the adopted waif. The note of Hatch upon a similar observation made of a similar feat of the Maryland yellow-throat is so apposite to the case in question that I quote it entire: "One of the most comical spectacles ever falling under my observation in bird life has been the appearance of a young cow-bird, nearly large enough to take to its wings, still sitting *on* (*in* was impossible) the nest of the Maryland yellow-throat,

and the female of that diminutive species in the act of feeding it. The tiny excavation could scarcely afford room for its feet, to say nothing of the body, and, with feathers fluffed so as to apparently double its size, the mouth extended to its utmost, while the midget foster-mother, at the hazard of being swallowed bodily, plunging her morsels far down the abysmal throat of the ungracious usurper, who has unavoidably destroyed the mother's own birdlings in the process of its development." (Birds of Minnesota, p. 274).

The other case observed was somewhat later in the month. In both cases there was but a single specimen of the parasite, as is usually the case, and not one of the bird's own offspring was to be found, which, I think, is also the usual thing.

In the case most critically studied the bird had left the nest and was diligently following the foster-parents, both of whom were in attendance upon it, now to the ground, now to a tree, and all the while persistently clamoring for food, which they were industriously seeking to supply. And it seemed to me there was in the eye of the usurper a look of impious maliciousness, which seemed to express a semi-consciousness of wild satisfaction in the scandalous imposition.

The observations were the more interesting to me in that from my earliest recollections of bird-habit and instinct the "chippy" was among the most wary and jealous of the slightest intrusion or interference about the nest. I have known the disturbance of even the foliage in proximity to be sufficient to result in its abandonment. A note in American Ornithology, p. 296, speaks of it in the same way, and refers to it as the most punctilious on this point, often deserting the nest even after the eggs had been deposited. I have myself known the nest to be deserted upon an apparently smaller provocation after the full complement of eggs had been laid. It has, therefore, seemed strange to me that an egg so different in size and markings should be accepted and brooded, or that after the full-grown intruder had flown it should yet be so tenderly cared for, though its vagabond nature must certainly be recognized! Is it probable that the maternal instincts are so strong as to overcome all scruples even of the tragic sort involved in the case under consideration?

If Spizella is the frequent victim of this parasitism I should be glad to know more about it. Of all the cases where I have found the eggs of the cow-bird in the nests of other birds, I have yet to find the first case of such in the nest of the "chippy." My observations may have been too limited, and I shall hereafter be on the lookout for making them more critical, and, at the same time, more extensive.

## LETTERS TO THE EDITOR.

***Correspondents are requested to be as brief as possible. The writer's name is in all cases required as a proof of good faith.

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

### AN INTELLIGENT SQUIRREL.

THE new home to which I removed this summer has about it two-thirds of an acre of ground bearing several old oaks, maples and other trees. Naturally enough, it has introduced me to a number of new acquaintances in furs and feathers. Of these the most interesting by far is a gray squirrel (*Sciurus Carolinensis*), the largest specimen I remember to have met. He made his first bow to us early in Septamber, taking his position one morning upon a red oak some twenty feet from the house, with his four feet spread widely on the main trunk, his head downward and his beautiful great brush poised above his gray back. Here he remained motionless for a time, peering into a second story window where two little children were busy at play. Directly one of the children—a five-year-old—caught sight of the curious eavesdropper, and made the usual hullabaloo over him, vigorously assisted by her younger brother. The squirrel paid little attention to their excitement, save that he changed his position a little, but continued his observations. For a while there was a mutual ad-

miration society in session, which adjourned only on the arrival of certain older members of my family. On nearly every pleasant day for the succeeding month we caught sight of him on one tree or another in the neighborhood, sometimes bearing a nut in his mouth, but oftener darting about as if simply enjoying himself among the variegated autumn leaves.

Our respect for this fellow-tenant of our grounds was greatly increased one day, when a neighbor, hearing us speak of him, told us how it came about that we enjoyed the pleasure of the little fellow's company. In this neighbor's yard stood a large tree on whose top was a stump left by a decayed and broken limb. One day it was determined to trim up this tree with some thoroughness. The workmen brought their ladder and began. Soon there appeared upon the scene a much disturbed gray squirrel. Excitement was evident in every movement as the trimming proceeded. Finally the workmen left their work for the day. When all had become quiet, my neighbor was privileged to see a curious sight—one which I cannot remember seeing or hearing described before. It was the removal of a squirrel family to a new home. The old squirrel seized each young one by the nape of the neck, while the little one threw its tail about the parent's neck, as if to hold on. Then the old one, with its precious freight, descended the tree to a boundary fence, and, by characteristic hops and runs, arrived at a hollow tree top between my house and my barn. Two or three such journeys were observed before the whole family was domiciled in the new quarters.

Whether this burden-bearer was the male or the female, I know not. Perhaps some reader of *Science* can tell me. Indeed, I do not know whether there are a pair of the old squirrels here or not. We have never been able to observe two together. It is plain that the old squirrel came to the conclusion that its young were unsafe in the former home. Was this an inference from observation of the falling branches? The mere presence of man could not have been the ground of the conclusion, for a group of boys had played about the tree all summer, and after the removal the squirrel's freedom from fear in the neighborhood of human beings was often remarked. Its action in this instance resembles intelligence more than mere instinct.

RAY GREENE HULING.

Cambridge, Mass.

### ST. LOUIS LIMESTONE IN POWESHIEK COUNTY, IOWA.

The St. Louis limestone described by Hall and White, and more recently by Keyes (Geol. Ia. First Am. Rep., 1892) was formerly known to occur only as far north as the eastern border of Mahaska County. Early in 1893 Bain traced this formation completely across the county in the beds of the Des Moines and South Skunk rivers, and in the North Skunk nearly to the northwestern corner. More recently several excellent exposures of this limestone have been discovered three miles above the southern line of Poweshiek County, thus extending its northern limit about ten miles beyond that previously reported. At one place nearly fifty feet of coal-measure strata were seen to rest upon the limestone. Generally, however, it was immediately overlaid with drift. Many fossils, in a fine state of preservation, were obtained from the marl which capped the rock.

ARTHUR J. JONES.

Iowa College, Grinnell, Ia.



### EXCHANGES.

[Free of charge to all, if of satisfactory character. Address N. D. C. Hodges, 874 Broadway, New York.]

For Sale.—A very fine telescope, length extended, twenty-five inches, closed, seven inches. Power twenty-five times. Good as new. Cost $25.00. Will sell for the best cash offer. B. S. Bowdish, Box 165, Phelps, N. Y.

For Sale or Exchange for last editions of Standard Works on Vegetable Anatomy or Physiology: Practical Zoology, Marshall & Hurst; Elements of Embryology, Foster & Balfour; Zoology, Macalister; Guide to the Study of Insects, Packard; Geological Studies and Shall We Teach Geology, Winchell. Also have duplicates of Experiment Station publications which would like to exchange for any not in my file. L. R. Jones, Burlington, Vt.

For exchange.—Skins of Aegialites nivosa, Ereunetes occidentalis, Aunnodramus Arldingi. A. rostratus, Chamara fasciata henshawi, etc., for native or foreign skins with full data. Send lists. A. W. Anthony, 2042 Albatross st., San Diego, California.

I have a Beck New National monocular microscope, accessories, microtome, mounting material and a large number of fine slides. Will exchange the whole or in part for a first class type-writer or photograph outfit. A. C. Gruhlke, Waterloo, Ind.

Offered sidebloom eggs of Bulimus oblongus and exotic land and freshwater shells in exchange for Helices not in collection. Send lists to G. K. Gude, 5 Gresbach Road, upper Holloway, London, England.

Would like to exchange 100 specimens of Canadian Indian Relics for a photo outfit. E. J. Waters, 33 Hoffman St., Auburn, N. Y.

### *Wants.*

A GEOLOGIST thoroughly conversant with the geology of the Southern States desires an engagement. Has complete knowledge of the economic geology of Iron, Coal, Lignite, as well as Clay and Kaolin. Five years' experience with Geological Surveys. Address K., 509 West Sixth Street, Austin, Texas.

WANTED.—Tuckerman's Geneva Lichenum and Carpenter on the Microscope, Wiley's Introduction to the Study of Lichens. State price and other particulars. Richard Lees, Brampton, Ont.

WANTED.—Icones Muscorum by W. D. Sullivant, with or without Supplement, but both preferred. Address, stating price and condition of books, Dr. G. N. Best, Rosemont, N. J.

WANTED.—A copy of Mascart & Joubert's Lessons in Electricity and Magnetism, Vol. I. Address R. W. Clawson, Vanderbilt University, Nashville, Tennessee.

CHEMIST.—Graduate of a polytechnical school, and studied photographic chemistry in Germany and Austria. Situation teaching or in analytical or experimental laboratory. M. B. Punnett, Rochester, N. Y.

WANTED.—A recent college graduate to assist in editorial work on Science. Those seeking large emoluments need not apply. N. D. C. Hodges, 874 Broadway, New York.